

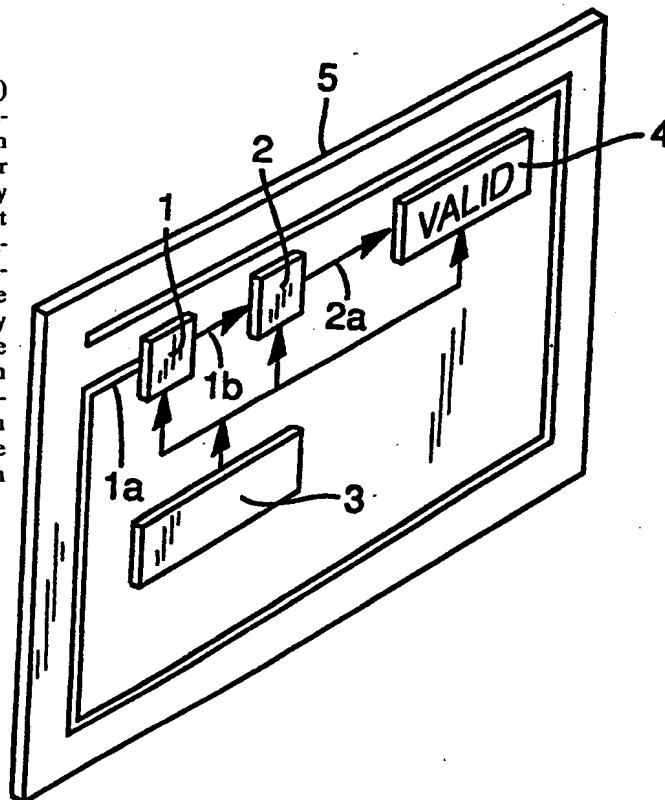


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(54) Title: CREDIT CARD WITH COMMUNICATION CAPABILITY**(57) Abstract**

The credit card (5) includes integrated circuitry (2) which can process data combined with integrated circuitry which provides point-to-point radio communication (1). The circuitry for processing data can be computer type circuitry such as the circuitry in what are generally termed Very Smart Credit Cards. The point-to-point communication circuitry can be time slot protocol paging circuitry such as that in certain time slot protocol radio pagers. The credit card makes it possible to update or deactivate a credit card from a remote location by sending signals over the communication channel. The communication channel can be used in conjunction with the clock in the card to insure that the card is automatically deactivated if a new radio communication which re-authorized the card is not received within preset time limits. This prevents a thief from inhibiting deactivation of the card by shielding it from radio communications.



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1 CREDIT CARD WITH COMMUNICATION CAPABILITY

2 Field of the invention

3 The present invention relates to credit cards and more
4 particularly to a credit card verification systems which
5 utilizes point to point electronic communication.

6 Background of the invention

7 Credit card fraud and misuse is a costly problem for
8 credit card companies. Credit card fraud and misuse can
9 involve the use of lost or stolen cards or alternatively
10 it can involve the use of a card to obtain credit beyond
11 the limit allowed for the particular card. One widely
12 used technique to minimize fraud involves the use of a
13 periodically printed booklet which lists stolen or
14 otherwise invalid credit cards. Prior to issuing credit,
15 a merchant checks to see if the credit card is listed in
16 the booklet. If the card is listed in the booklet,
17 credit is refused.

18 With a another widely used system, the store clerk uses a
19 telephone or an electronic terminal device to check the
20 credit card number with a central computer facility. In
21 some existing systems the card number is read from the
22 magnetic stripe on the card and automatically sent to a
23 central computer where the status of the account is

1 checked and reported to the merchant. The merchant is
2 then either authorized to issue the credit or told not to
3 advance the credit.

4 One problem with present day systems is that the store
5 clerk or merchant is put in jeopardy when he must tell
6 the card holder that the card is not valid or that credit
7 is refused. The communication of such information to the
8 card holder may precipitate a violent reaction. One
9 aspect of the present invention is that it minimizes the
10 need for the merchant or clerk to discuss whether or not
11 a card is valid.

12 The first credit cards that came into widespread use were
13 simply plastic cards with raised lettering. The raised
14 lettering provided a means to manually imprint credit
15 card vouchers. Later credit cards were developed that
16 included a magnetic stripe on the card. The magnetic
17 stripe provides a means whereby a terminal can
18 automatically read information directly from the credit
19 card. Such cards are in widespread use today.

20 A relatively new development is a credit card that
21 contains imbedded electronic circuitry including memory
22 circuits that can store information concerning the cards
23 "open to buy" status. Such credit cards are often
24 referred to as "Smart Cards". An article published in
25 Spectrum, Institute of Electrical and Electronic

1 Engineers, October 1988, page 35, and the references
2 cited therein, give a description of the present state of
3 the art relative to credit cards that include electron ic
4 circuitry.

5 The electronic circuitry imbedded in "Smart Cards"
6 generally includes a microprocessor, a read only memory
7 (ROM), a programmable read only memory (PROM) and a
8 random access memory (RAM). Smart Cards do not have any
9 built-in devices which can be used to manually provide
10 data to the card's internal microprocessor. Smart Cards
11 must interact directly with electronic terminal equipment
12 in order to provide data or information to the circuitry
13 inside the card. Furthermore, Smart Cards generally do
14 not include any built-in devices which can display
15 information stored in the card. In order to interrogate
16 or update a card's "open to buy" status the Smart Card
17 must interact with relatively expensive transaction
18 support equipment. The widespread use of Smart Cards has
19 been somewhat inhibited by the need to use relatively
20 expensive terminal equipment connected to a central
21 computer each time the information in the card is
22 interrogated or updated.

23 The above referenced Spectrum article also describes a
24 relatively new development, termed a "Very Smart Card".
25 The Very Smart Cards described in the Spectrum article
26 include a keyboard that makes it possible to manually

1 input data or information into the circuitry inside the
2 card. Very Smart Cards also include a display so that
3 the card can be manually interrogated to determine
4 information stored therein such as its "open to buy"
5 status.

6 The Very Smart Cards described in the referenced Spectrum
7 article are the size of a conventional credit card (554.0
8 by 85.6 by 0.76 millimeters) and they include embedded
9 therein a battery, a central processing unit (CPU),
10 16,000 bytes of ROM, 8,000 bytes of RAM, a real-time
11 clock and calendar, a keyboard, a controller, a
12 transducer that emulates a magnetic stripe, and
13 electrical contacts that can interact with contacts in a
14 terminal.

15

16 Very Smart Card were designed to eliminate the need for a
17 direct interaction with an expensive terminal each time
18 one wanted to update a card's "open to buy" information.
19 With a Very Smart Card, each month when the issuing bank
20 furnishes the cardholder with a monthly statement, the
21 bank also provides the card holder with a set of numbers.
22 The card holder is instructed to key the set of numbers
23 into the associated Very Smart Card. The numbers which
24 are keyed into the card update the card's "open to buy"
25 status. Thus the bank can reset the usage limits
26 according to the user's payment behavior. If the user is
27 traveling and has not received a statement with the new

1 set of numbers for the card, the card holder can take the
2 card to any member bank, where it is inserted into a
3 terminal and the appropriate set of numbers is downloaded
4 into the card. As with conventional cards, various
5 operations in a Very Smart Card are protected by
6 requiring the use of a Personal Identification or PIN
7 number.

8 The Very Smart Card is a significant improvement over the
9 Smart Card; however, the need to periodically manually
10 key a new set of numbers into the card is a distinct
11 limitation of the Very Smart Card. Furthermore, if a Very
12 Smart Card is stolen, there is no way to deactivate the
13 card until it is inserted into a terminal that is
14 connected to a central computer.

15 The present invention provides an improved credit card
16 which utilizes point to point radio communication to
17 provide an indication of whether a card is valid.

18 Summary of the Invention

19 The present invention uniquely combines credit card
20 technology, integrated circuitry technology, and point-
21 to-point radio communication technology. A credit card
22 built in accordance with the present invention includes
23 integrated circuitry which can process data combined with
24 integrated circuitry which provides point-to-point radio
25 communication. The circuitry for processing data can be

1 relatively simple electronic circuitry that merely
2 activates an indication of whether or not the card is
3 valid or it can be computer type circuitry such as the
4 circuitry in what are generally termed Very Smart Credit
5 Cards. The point-to-point communication circuitry can be
6 time slot protocol paging circuitry such as that in
7 certain time slot protocol radio pagers. The present
8 invention makes it possible to update or deactivate a
9 credit card from a remote location by sending signals
10 over the communication channel. Thus a card can be
11 deactivated or updated even while the card is in the
12 user's pocket or wallet. The communication channel can
13 be used in conjunction with the clock in the card to
14 insure that the card is automatically deactivated if a
15 new radio communication which re-authorized the card is
16 not received within preset time limits. This prevents a
17 thief from inhibiting deactivation of the card by
18 shielding it from radio communications.

19 Description of the Drawings

20 Figures 1A and 1B show perspective views of the inside
21 and outside of a first embodiment of a credit card built
22 in accordance with the present invention.

23 Figure 2A shows the outside appearance of a second
24 embodiment of a credit card which includes the present
25 invention.

1 Figure 2B is an exploded perspective view of a second
2 embodiment of a credit card built in accordance with the
3 present invention.

4 Figure 3 is a diagram of the overall system of the
5 present invention.

6 Figure 4 is a block diagram of the circuitry in a credit
7 card build in accordance with the present invention.

8 Detailed Description of the Invention

9 A first embodiment of the present invention is shown in
10 Figures 1A and 1B. Figure 1A shows the back substrate 5
11 and with four electronic elements 1 to 4 mounted thereon.
12 Figure 1B shows a top cover 6 which has a window 7 and
13 normal raised lettering 8. When cover 6 is mounted on
14 substrate 5, the resulting structure has the dimensions
15 of a conventional credit card, namely, 554.0 by 85.6 by
16 0.76 millimeters

17 Electronic elements 1 to 4 are mounted within the credit
18 card in a conventional manner such as the electronic
19 elements are mounted in a Smart Card. Alternatively,
20 backplate 5 can be a printed circuit board with
21 electrical lines thereon and electronic elements 1 to 4
22 can be surface mounted and connected to circuit lines on
23 backplate 5.

1 Element 1 is a point to point radio receiver which has an
2 associated loop antenna 1a. The radio receiver 1 and the
3 antenna 1a are built to receive messages or signals
4 transmitted from commercial radio stations as an FM
5 subcarrier in accordance with the time slot protocol
6 described in Patent 4,713,808 Gaskill et. al., or in
7 copending application serial number _____, filed
8 _____. Alternatively, other point-to-point
9 communications technologies could be used. The details
10 of how information is sent to receiver 1 will be
11 described later with reference to Figure 3 and 4.

12 The output 1b of point to point radio receiver 1 is
13 connected to logical circuitry 2. Logical circuitry 2
14 can be a conventional gate array that receives and
15 decodes signals from radio receiver 1 and which activates
16 a display 4. Elements 1,2, and 4 are powered by a
17 conventional watch battery 3.

18 The display 4 can be a simple display that is either
19 blank or which activates a simple icon in response to
20 signals from radio receiver 1. In a simple embodiment,
21 the display 4 can either display the words VALID or VOID.
22 The logic in block 2 can include a timer which switches
23 the display to VOID if an appropriate signal is not
24 received via point to point receiver 1 within a preset
25 interval. In a system where the card has a high credit

- 1 limit such an interval might be set to one hour or less.
- 2 Alternatively, in order to economize on communication
- 3 time, the display might normally be set to VALID except
- 4 when a signal is received indicating that the display
- 5 should be switched to VOID.
- 6 One advantage of this system is that the card shows on
- 7 its face as to whether or not it is valid. Thus the
- 8 clerk need not communicate this information to the card
- 9 holder. This minimizes the danger to the clerk who is
- 10 handling the transaction. There is no need for the
- 11 clerk to look up information or for the clerk to take any
- 12 action. With the present invention, the card can on its
- 13 face show whether or not it is valid. The valid or
- 14 invalid indication can be activated from a remote
- 15 location in an automatic fashion when the bank's computer
- 16 determines that the cards limit has been exceeded.
- 17 Alternatively, if a card is stolen or lost, the
- 18 indication can be activated by a telephone call to the
- 19 bank which in turn would activate the point to point
- 20 communication device with the appropriate message.
- 21 The point to point communication device 1 merely need
- 22 receive a message and provide a set of signals to logic
- 23 circuit 2. Logic circuit 2 in turn decodes the message
- 24 into an ON or OFF condition for the display 4. Logic for

1 converting a binary message from a receiver 1 into
2 control signals is well know and will not be explained in
3 detail. The details of receiver 1 are shown in Figure 4
4 and will be explained in more details with reference to
5 the second embodiment of the invention.

6 An alternate embodiment of the present invention adapted
7 for use in a credit card 10 is shown in Figures 2A and
8 2B. The dimensions of the card 10 are conventional, that
9 is, the card is 554.0 by 85.6 by 0.76 millimeters. The
10 card 10 includes a keyboard 11 and a display 12 that are
11 similar to the keyboard and display included in the Very
12 Smart Card described in the previously referenced
13 Spectrum article.

14 Figure 2B shows in a diagrammatic exploded view the
15 internal structure of the card 10. A number of
16 integrated circuits 21 are mounted inside the card on a
17 backplane 24. An antenna 22, and a display 12 are also
18 mounted on backplane 24. The circuitry is covered with a
19 sheet 25. The details of the circuitry 21 inside the
20 card will be explained later with reference to Figures 3
21 and 4.

22 The details of mounting the integrated circuits 21 inside
23 the card are not specifically shown since these are
24 conventional and can be similar to the structure of known
25 Smart and Very Smart Cards. The numeral 21 designates

1 all of the integrated circuits inside the card. The
2 details of how the circuits are interconnected is shown
3 in Figure 3 and 4. The manner of mounting the circuits
4 21 on backplate 24 can be conventional. In the simplest
5 form of packaging, the integrated circuits 21 can be
6 surface mounted on a printed circuit board 24 which forms
7 the back of the card. The circuits can then be
8 encapsulated with conventional encapsulating material and
9 the entire assembly covered with a top sheet 25 which
10 will form the top or front of the card.

11 The circuitry inside the credit card can be divided into
12 two main parts 31 and 32 as shown in Figure 3. Circuitry
13 31 is a point-to-point radio receiver and circuitry 32 is
14 relatively conventional computer circuitry of the type
15 found in Smart and Very Smart cards. Additional detail
16 concerning the circuitry is shown in Figure 4 and will be
17 explained later with reference to Figure 4.

18 The radio receiver 31 and the antenna 22 are built to
19 receive signals transmitted from commercial radio
20 stations as an FM subcarrier in accordance with the time
21 slot protocol described in Patent 4,713,808 Gaskill et.
22 al., or in copending application serial number _____,
23 filed _____. Alternatively, other point-to-point
24 communications technologies could be used.

1 The credit card 10 is designed to operate in a system
2 where credit authorization information is communicated to
3 the card via the point-to-point radio receiver 31. A
4 computer 34A in a bank or clearing house 34 would contain
5 the principal accounting records. The computer in the
6 bank 34 would be programmed to generate credit limits for
7 each card monitored by the system. These credit limits
8 would be used to calculated "open to buy" values for each
9 credit card. The "open to buy" value is coded into a
10 sequence of digits similar to the sequence of digits that
11 must be manually keyed into what are termed Very Smart
12 Cards.

13 The sequence of digits generated by the computer 34A in
14 bank 34 are sent to a subcarrier generator 35 which can
15 be similar to the subcarrier generator described in the
16 previously referenced patent and patent application. The
17 subcarrier generator 35 in turn send the information to
18 FM radio transmitter 36 which broadcasts these digits as
19 part of a time slot message. The information broadcast
20 by radio station 36 is received by receiver 31.

21 The broadcast protocol can be similar to that described
22 in the previously referenced patent so that a particular
23 sequence of numbers can be directed to one and only one
24 credit card. Thus a card's "open to buy" limits can be
25 updated without the necessity of the operator keying a
26 number into the card.

1 Furthermore, if a credit card is stolen, the computer 34A
2 can receive a loss notification report by telephone 33
3 and very quickly send out a message that deactivates that
4 particular credit card. The cost to companies of fraud
5 perpetrated by lost or stolen credit cards is very high.
6 The ability to quickly deactivate a credit card is a
7 distinct advantage. With the present invention, a credit
8 card can be deactivated while it is in a thief's pocket
9 without any action or notice to the thief.

10 One possible alternate embodiment of the present
11 invention
12 is a system that includes either an alarm or a radio
13 transmitter in a credit card. In this way, when a credit
14 card is stolen the point-to-point communication device
15 could be used to activate the radio transmitter which
16 could then be used to locate the thief. Alternatively or
17 in addition, the point-to-point communication device
18 could be used to set a control in the card so that the
19 next time the thief tries to use the card, a message will
20 be given to the merchant indicating that the card was
21 stolen.

22 Another alternate embodiment of the invention provides
23 means whereby normal paging messages such as "call 444-
24 1212" can be displayed on display 12. In this way the
25 credit card 10 can also serve as a point-to-point paging

1 receiver of the type shown in the previously referenced
2 patent and patent application.

3 The programming in the various computers in the system is
4 not explained in detail since it is conventional and
5 state of the art once the function and overall
6 combination of components is known. Furthermore, after
7 the combination of hardware is known and the overall
8 functions are specified the computer inside the credit
9 card can easily be programmed to perform the desired
10 functions. For example, if desired, the computer can
11 periodically interrogate the clock and put an appropriate
12 note on the display if the "open to buy" status has not
13 been updated within a specified period.

14 Figure 4 shows additional detail of the circuitry inside
15 the credit card. The circuitry is divided into two
16 parts. The first part of the circuitry designated 32 is
17 similar or identical (except for programming) to the
18 circuitry in what is termed a Very Smart Card. This
19 circuitry includes I/O contacts 41, serial I/O 42, a
20 central processing computer 43, an I/O device 44 with an
21 associated magnetic transducer 47 and a keyboard 11. The
22 system also includes a program memory 48, a data memory
23 49, a clock 50, an LCD driver 45 and an LCD display 12.
24 The various units are interconnected by a data and
25 control bus 52.

1 The second part of the circuitry inside the card is a
2 point-to-point communication device 31. The point-to-
3 point communication device 31 is designed to receive and
4 transmit to the circuitry 32, a sequence of numbers.
5 This sequence of numbers either resets the card's "open
6 to buy" limit or it deactivates the card. The point-to-
7 point communication device 31 is similar to the radio
8 paging device described in the previously referenced
9 patent application. Key aspects of the device are the
10 ability to individually address a large number of
11 receivers and the ability to operate with very low power
12 drain. As described in the above referenced patent and
13 patent application, the point-to-point communication
14 device 31 includes a radio receiver 56, a subcarrier data
15 demodulator 55 which digitizes the signal from the
16 receiver and then extracts the required information, a
17 decoder 54 which decodes the protocol, and a
18 microprocessor 53 which controls the entire process.

19 Each credit card has an assigned registration number.
20 The point-to-point receiver 31, compares received
21 messages to the assigned registration number and only
22 operates on messages designated as being for the
23 particular receiver. The receiver operates on a time
24 slot protocol that requires the receiver to be operative
25 for only a very short period of time, thereby extending
26 battery life. The receiver 56 is frequency agile so that

1 it can automatically scan a variety of commercial
2 stations for appropriate messages.

3 While the invention has been described with reference to
4 preferred embodiments thereof, it will be understood by
5 those skilled in the art that various changes in form and
6 detail may be made without departing from the spirit and
7 scope of the invention. From this description of the
8 preferred embodiment of the invention, those skilled in
9 the art will recognize a wide variety of applications,
10 alternate embodiments and variations in detail of the
11 invention.

12 What is claimed is:

- 1 1. An electronic credit card including in combination,
2 electronic computer circuitry adapted to store
3 information concerning credit limits,
4 a point-to-point radio receiver adapted to receive and
5 transmit information to said electronic computer
6 circuitry,
7 whereby the open to buy status of said credit card can be
8 updated from a remote location without the need for an
9 electronic terminal and without any manual intervention
10 at the location where said credit card is located.
- 11 2. The credit card recited in claim 1 wherein said
12 circuitry is embedded within said credit card.
- 13 3. The credit card recited in claim 2 wherein said credit
14 card has the dimensions of a standard credit card.
- 15 4. The credit card recited in claim 3 wherein said credit
16 card includes a display which is driven by the electronic
17 circuitry in said credit card.

- 1 5. A credit card validation system that includes,
2 a plurality of credit cards, each of which include means
3 for electronically storing information related to the
4 authorization limit for the particular credit card, and a
5 point-to-point radio receiver,
6 means in each credit card for receiving information
7 transmitted to said cards via radio waves,
8 whereby the authorization limits of said credit cards can
9 be updated from a remote location.
- 10 6. The system recited in claim 5 wherein said information
11 is transmitted to said credit card by means of a time
12 slot protocol system.
- 13 7. The system recited in claim 5 wherein each of said
14 credit cards contain a battery to power said radio
15 receiver.
- 16 8. The credit card recited in claim 1 wherein a battery
17 is implanted in said credit card.

1 9. The credit card recited in claim 1 wherein said point-
2 to-point radio receiver is a receiver that operates
3 according to a time slot protocol.

4 10. The credit card recited in claim 9 wherein said radio
5 receiver is normally in a low power state and wherein
6 said receiver is only in a high power state during
7 selected time slots of said time slot protocol.

8 11. A credit card including imbedded therein,
9 electronically activated display means for indicating
10 whether or not the card is valid,

11 a point-to-point radio receiver for receiving
12 information,

13 means for controlling said display means in response to
14 signals received on said point to point communication
15 device.

16 whereby a visual display indicating whether or not said
17 card is valid can be activated from a remote location
18 without any action by the holder of said card.

1/3

FIG.1A

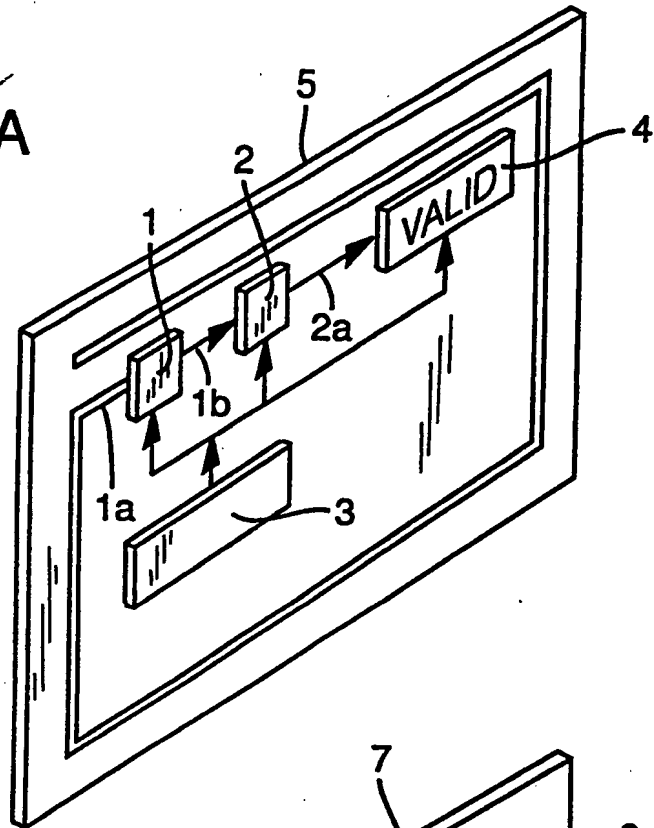
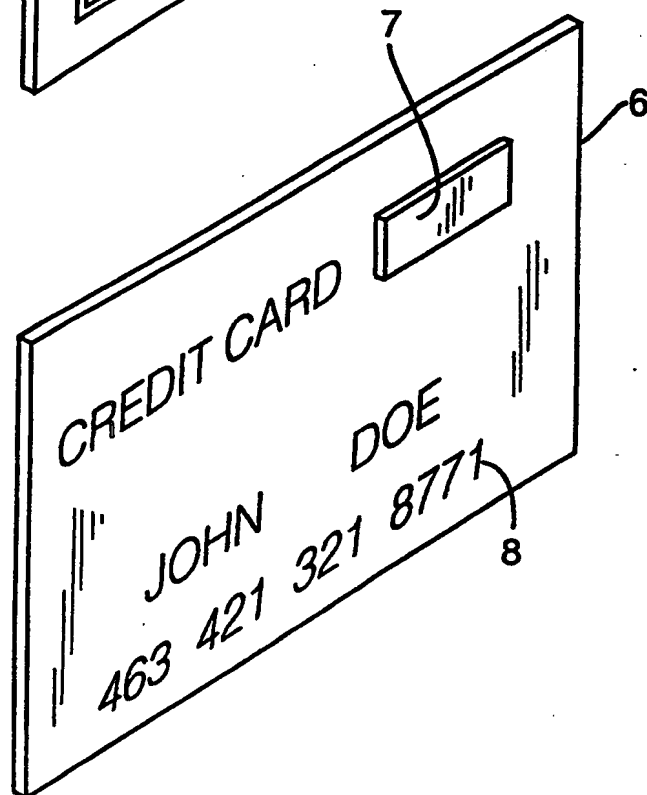


FIG.1B



2/3

FIG.2A

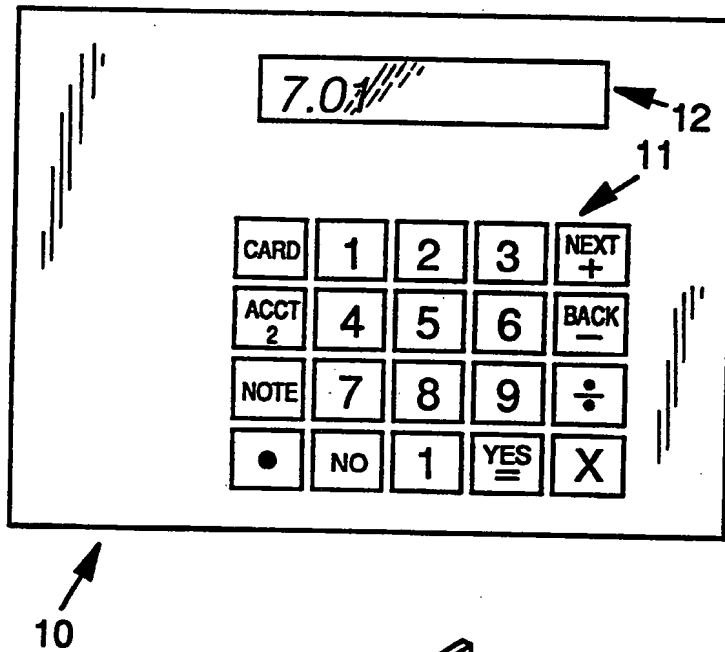


FIG.2B

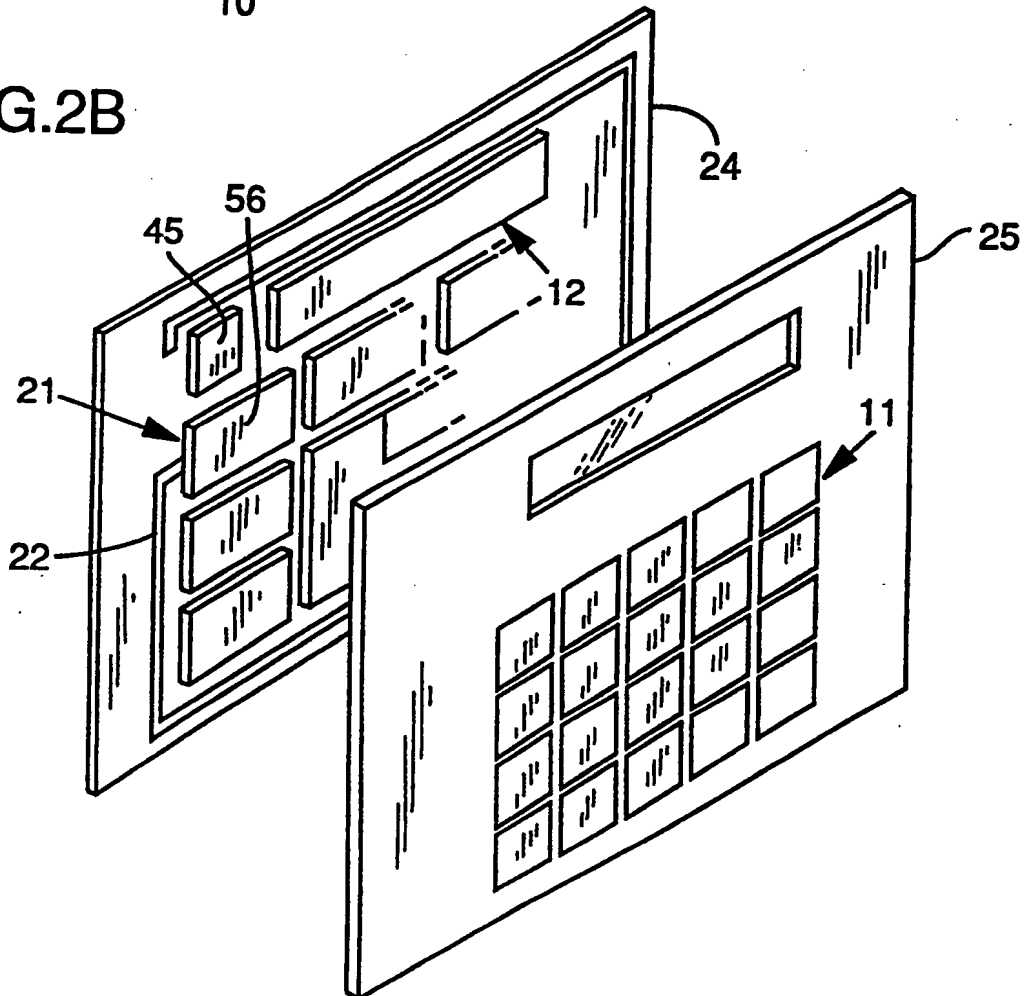


FIG. 3

3/3

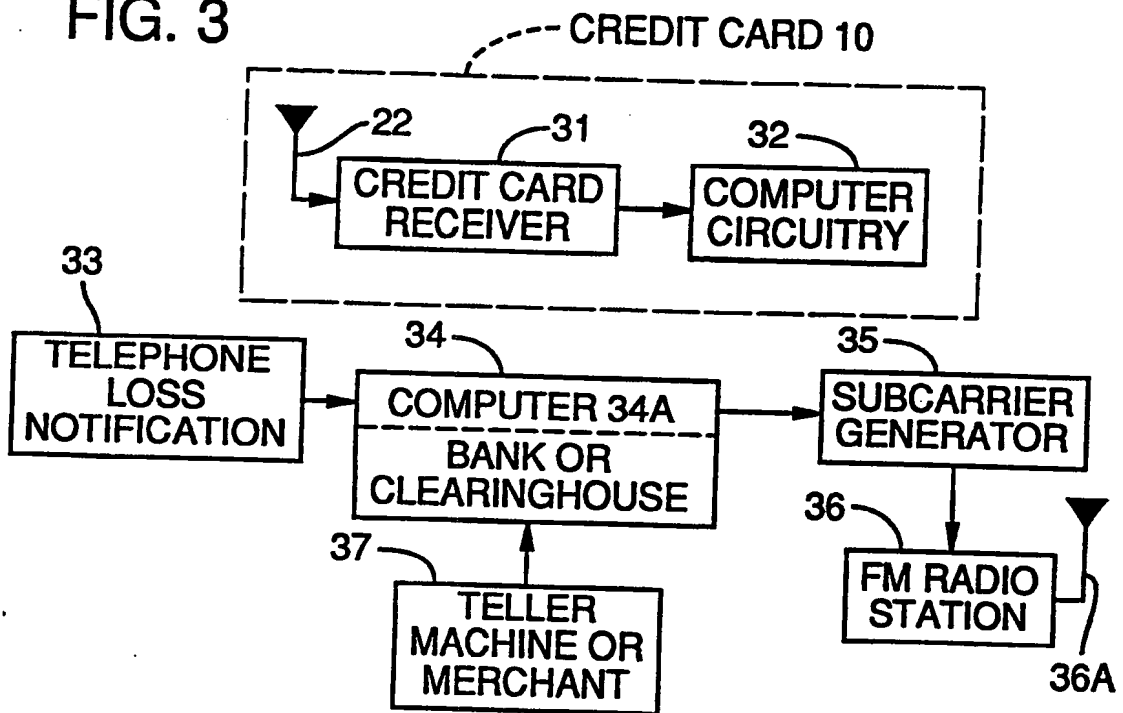
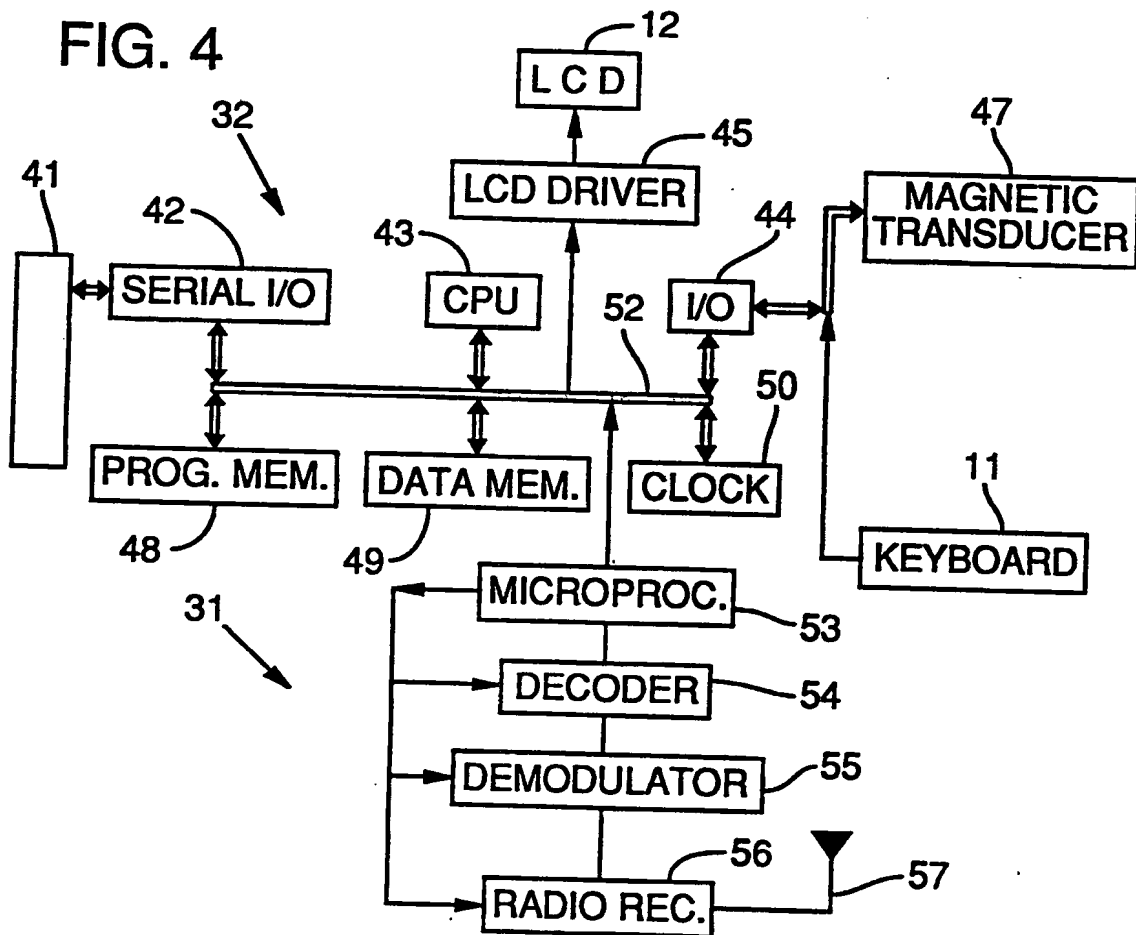


FIG. 4



INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US90/01511

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) *

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(5): G07D 7/00

US CL.: 340/825, 340

II. FIELDS SEARCHED

Classification System	Minimum Documentation Searched ⁷	Classification Symbols
U.S.	235/380-382.5 340/505, 571-573, 825.3-825.34, 825.54, 825.69, 825.72 368/10-12; 380/21, 23	

Documentation Searched other than Minimum Documentation
to the extent that such Documents are included in the Fields Searched *

III. DOCUMENTS CONSIDERED TO BE RELEVANT *

Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y	US,A, 4,236,068 Walton 25 November 1980 See column 8, lines 62-68 and lines 56-58	1 - 11
Y	Scientific American, Volume 253, Number 5, November 1985, Robert McIvor, "Smart Cards", pages 152-159 See page 152, columns 1 and 2.	1 - 11

* Special categories of cited documents: ¹⁰

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

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"A" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

30 May 1990

Date of Mailing of this International Search Report

08 AUG 1990

International Searching Authority

ISA/US

Signature of Authorized Official: NGUYEN NGOC-HO

INTERNATIONAL DIVISION
Ulysses Weldon